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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of DEBERNARDI

Application No.

Examiner:

Filed: Herewith

Group Art Unit:

For: METHOD AND APPARATUS FOR AMMONIA SYNTHESIS GAS PRODUCTION

SUBMISSION OF COPY OF INTERNATIONAL APPLICATION

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please find attached a copy of the International application as filed. Please note that the application attached hereto is for information purposes only, as an amended version is filed herewith.

Respectfully submitted,

Dated: 12-28-04



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Docket No. 9526-47

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For: METHOD AND APPARATUS FOR AMMONIA SYNTHESIS GAS PRODUCTION

**SUBMISSION OF COPY OF ANNEXES TO INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**


Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please find attached a copy of the Annexes to the International Preliminary Examination Report. Please note that the claims attached hereto are for information purposes only, as they are further amended in a preliminary amendment filed herewith.

Respectfully submitted,

Dated: 12-28-04


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REPLACED BY
ART 34 AMDT

- 11 -

CLAIMS

1. Method for ammonia production through a catalytic reaction of pressurised synthesis gas in an appropriate compressor with many stages (1, 2), each of which is
5 equipped with an inlet and outlet (1a, 2a, 1b, 2b, 2c) for said synthesis gas, which method includes a purification step through liquid ammonia of said synthesis gas from water and carbon dioxide contained in it, characterised in that said purification comprises the operating steps of:
- 10 - arranging a gas-liquid mixer (16) in fluid communication, on one side with the outlet (1b) of a first stage (1) of said compressor or with the outlet of an intermediate stage thereof and, on the other side, with the inlet (2b) of a stage (2) immediately following said first stage (1) or
15 said intermediate stage, said mixer (16) having a portion of reduced cross section, extending for a prearranged axial length,
- axially feeding into said mixer (16) a flow of synthesis gas outbound from said first stage (1) or from said
20 intermediate stage at the same time as a flow of liquid ammonia, said flows being coaxial and in co-current,
- separating substantially anhydrous synthesis gas from the mixture of said flows outbound from said mixer (16) and sending said gas into said stage (2) following said first
25 stage (1) or said intermediate stage.
2. Method according to claim 1, characterised in that said flow of synthesis gas is cooled to a temperature of between +8°/-20°C, before being fed into said mixer (16).

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3. Method according to claim 2, characterised in that said cooling is carried out through a flow of liquid ammonia.

4. Method according to claim 3, characterised in that said cooling is carried out upstream of the inlet of said
5 coaxial flows of synthesis gas and of liquid ammonia in said mixer (16).

5. Method according to claim 1, characterised in that said flow of liquid ammonia is fed into said mixer (16) in the form of a plurality of high speed jets.

10 6. Method according to claim 5, characterised in that said flow of liquid ammonia is fed into said mixer (16) making it pass through a nozzle (23) equipped with appropriate suitably sized openings or slits.

15 7. Apparatus for carrying out the method of claims 1 to 6, comprising a compressor with many stages (1, 2), each of which is equipped with an inlet and an outlet (1a, 2a, 1b, 2b, 2c), characterised in that it comprises a gas-liquid mixer (16) in fluid communication, on one side with the outlet (1b) of a first stage (1) of said compressor or with
20 the outlet of an intermediate stage thereof and, on the other side, with the inlet (2b) of a stage (2) immediately following said first stage (1) or said intermediate stage, said mixer (16) having a portion (16a) of reduced cross-section, extending for a prearranged axial length.

25 8. Apparatus according to claim 7, characterised in that a gas-liquid separator (8) is placed between said mixer (16) and said subsequent stage (2) of said compressor.